

computing device, although the invention is not limited thereto. While various aspects of the invention may be illustrated and described as block diagrams, flow charts, or using some other pictorial representation, it is well understood that these blocks, apparatus, systems, techniques or methods described herein may be implemented in, as non-limiting examples, hardware, software, firmware, special purpose circuits or logic, general purpose hardware or controllers, other computing devices and/or some combination thereof.

[0199] The exemplary embodiments of the inventions may be practiced in various components such as integrated circuit modules. The design of integrated circuits is by and large a highly automated process. Complex and powerful software tools are available for converting a logic level design into a semiconductor circuit design ready to be etched and formed on a semiconductor substrate.

[0200] As such, it should be appreciated that at least some aspects of the exemplary embodiments of the inventions may be practiced in various components such as integrated circuit chips and modules. It should thus be appreciated that the exemplary embodiments of this invention may be realized in an apparatus that is embodied as one or more integrated circuits, where the one or more integrated circuits may comprise circuitry (as well as possibly firmware) for embodying at least one or more of a data processor, a digital signal processor, baseband circuitry and radio frequency circuitry that are configurable so as to operate in accordance with the exemplary embodiments of this invention.

[0201] Programs, such as those provided by Synopsys, Inc. of Mountain View, Calif. and Cadence Design, of San Jose, Calif. automatically route conductors and locate components on a semiconductor chip using well established rules of design as well as libraries of pre stored design modules. Once the design for a semiconductor circuit has been completed, the resultant design, in a standardized electronic format (e.g., Opus, GDSII, or the like) may be transmitted to a semiconductor fabrication facility or "fab" for fabrication.

[0202] The foregoing description has provided by way of exemplary and non-limiting examples a full and informative description of the invention. However, various modifications and adaptations may become apparent to those skilled in the relevant arts in view of the foregoing description, when read in conjunction with the accompanying drawings and the appended claims. However, all such and similar modifications of the teachings of this invention will still fall within the scope of the non-limiting and exemplary embodiments of this invention.

[0203] Furthermore, some of the features of the preferred embodiments of this invention could be used to advantage without the corresponding use of other features. As such, the foregoing description should be considered as merely illustrative of the principles, teachings and exemplary embodiments of this invention, and not in limitation thereof

[0204] The following abbreviations that may be found in the specification and/or the drawing figures are defined as follows:

- [0205] 3GPP third generation partnership project
- [0206] ABS almost blank subframe
- [0207] ADC analog to digital converter/conversion
- [0208] AGC automatic gain control
- [0209] AP access point
- [0210] BS base station
- [0211] BW bandwidth
- [0212] CDMA code division multiple access

- [0213] CRE cell range expansion
- [0214] CRS cell-specific reference signal
- [0215] DCI downlink control information
- [0216] DL downlink (eNB towards UE)
- [0217] eICIC enhanced inter-cell interference coordination (enhanced ICIC)
- [0218] eNB E-UTRAN Node B (evolved Node B)
- [0219] EPC evolved packet core
- [0220] E-UTRAN evolved UTRAN (LTE)
- [0221] FDMA frequency division multiple access
- [0222] FER frame error rate
- [0223] FFT fast Fourier transform
- [0224] GSM global system for mobile communication
- [0225] HeNB home eNB
- [0226] HetNet heterogeneous network
- [0227] HSPA high speed packet access
- [0228] IC interference cancellation
- [0229] ICIC inter-cell interference coordination
- [0230] IEEE institute of electrical and electronics engineers
- [0231] IMT-A international mobile telephony-advanced
- [0232] ITU international telecommunication union
- [0233] ITU-R ITU radiocommunication sector
- [0234] LAN local area network
- [0235] LTE long term evolution of UTRAN (E-UTRAN)
- [0236] LTE-A LTE advanced
- [0237] MAC medium access control (layer 2, L2)
- [0238] MM/MME mobility management/mobility management entity
- [0239] Node B base station
- [0240] OFDMA orthogonal frequency division multiple access
- [0241] O&M operations and maintenance
- [0242] PBCH physical broadcast channel
- [0243] PCFICH physical control format indicator channel
- [0244] PCI physical cell identifier
- [0245] PDCCH physical downlink control channel
- [0246] PDCP packet data convergence protocol
- [0247] PHICH physical hybrid-ARQ indicator channel
- [0248] PHY physical (layer 1, L1)
- [0249] RAN# technical specification group radio access network working group #
- [0250] RE range extension
- [0251] Rel release
- [0252] RLC radio link control
- [0253] RRC radio resource control
- [0254] RRM radio resource management
- [0255] RS reference signal
- [0256] RSRP reference signal received power
- [0257] S GW serving gateway
- [0258] SC FDMA single carrier, frequency division multiple access
- [0259] SIC successive interference cancellation
- [0260] SINR signal to interference plus noise ratio
- [0261] SNR signal to noise ratio
- [0262] TD-SCDMA time division synchronous code division multiple access
- [0263] UE user equipment, such as a mobile station, mobile node or mobile terminal
- [0264] UL uplink (UE towards eNB)
- [0265] UMA-LoS urban macro line of sight (channel model)